

0.7

Return (X)

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

ANNUAL REPORT AND INVESTIGATIVE PROGRAM

April 1, 1933

1932-1933



NORTHEASTERN FOREST EXPERIMENT STATION

AMHERST, MASSACHUSETTS

835 PROSPECT STREET,
NEW HAVEN, CONN.

M-5123

U. S. GOVERNMENT PRINTING OFFICE: 1930

8-7417

NORTHEASTERN FOREST EXPERIMENT STATION
OFFICE LIBRARY

United States Department of Agriculture

Forest Service

NORTHEASTERN FOREST EXPERIMENT STATION

New Haven, Conn.

ANNUAL REPORT AND INVESTIGATIVE PROGRAM

April 1, 1933

NORTHEASTERN FOREST RESEARCH COUNCIL

Appointed by the Secretary of Agriculture to serve in an advisory capacity to the Northeastern Forest Experiment Station and to coordinate and stimulate forest research by all agencies in the Northeast.

Maine

G. T. Carlisle, Jr.	Consulting Forester.
N. L. Violette	State Forest Commissioner.

New Hampshire

W. R. Brown	President, New Hampshire Timberland Owners Association.
J. H. Foster	State Forester.
J. C. Kendall	Director, New Hampshire Experiment Station and Extension Service.
L. F. Whittemore	General Agent, Boston & Maine Railroad.

Vermont

P. H. Merrill	Commissioner of Forestry.
B. S. Ward	President, Ward Lumber Company.

Massachusetts

H. P. Baker	President, Massachusetts State College.
W. A. L. Bazeley	Commissioner of Conservation.
R. T. Fisher	Director, Harvard Forest.
E. H. Thomson	President, Federal Land Bank.

Connecticut

H. S. Graves	Dean, Yale School of Forestry.
A. F. Hawes	State Forester.
W. L. Slate	Director, Connecticut Agricultural Experiment Station.

Rhode Island

H. R. Lewis	Commissioner of Agriculture.
-------------	------------------------------

New York

R. S. Hosmer	Head, Dept. of Forestry, Cornell University.
W. G. Howard	Supt. Lands and Forests, Conservation Department.

New York (Continued)

R. S. Kellogg

Secretary, News Print Service
Bureau.

G. N. Ostrander

Manager, Woodlands Department,
Finch, Pruyn and Company.

G. W. Sisson, Jr.

President, Sacquette River Paper
Company.

NORTHEASTERN FOREST EXPERIMENT STATION

Personnel

Permanent

Forest Service

C. Edward Behre	Director
Guy R. Stewart	Senior Forest Ecologist
M. Westveld	Silviculturist
Paul W. Stickel	Associate Silviculturist
Lester H. Reineke	Associate Silviculturist
Victor S. Jensen	Assistant Silviculturist
Harold F. Morey	Junior Forester
Richard H. Blythe, Jr.	Junior Forester
Mary E. Turrell	Senior Clerk
Eather E. Scott	Assistant Clerk
Catherine A. Heaphy	Assistant Clerk
(In cooperation with Division of State Cooperation)	
Mary C. Weldon	Junior Clerk
Dorothy E. Martin	Assistant Computing Aid

Bureau of Plant Industry

Perley Spaulding	Senior Pathologist
J. R. Hansbrough	Assistant Pathologist

Bureau of Entomology

H. J. Macaloney	Assistant Entomologist
-----------------	------------------------

Bureau of Biological Survey

J. Paul Miller	Junior Biologist
----------------	------------------

Temporary

Fred H. Arnold	Harold Eno
Lowell Besley	Kenneth Hinkley
Chester A. Coover	H. A. Howell
J. W. Johnston, Jr.	

Collaborators

M. F. Morgan)	Connecticut Agricultural Experiment Station
H. J. Lunt)	
H. B. Peirson	Maine Forest Service

CONTENTS

General	1
Research Council	1
Experimental Forests	4
Use of Experimental Forests for Research Projects	7
Administrative Research	9
Cooperation	9
Summary of Accomplishments	12
Forestation	12
Management of Spruce Hardwoods	13
Pathology	13
Mensuration	14
Fire Protection	15
Entomology and Biology	16
Publications	17
Financial Estimates for Fiscal Year 1934	21
Detailed Project Statements (With Index)	24

Northeastern Forest Experiment Station
Annual Report and Investigative Program 1933

General

In June, 1932, the headquarters of the station were moved from the Massachusetts State College, at Amherst, Massachusetts, to Yale University, New Haven, Connecticut. This move became necessary when administrative problems at the Massachusetts State College and the growth of the forest experiment station made it impossible for the College to continue to afford the quarters which had been made available since the establishment of the Station in 1923. At Yale the station has been given exclusive use of a building which is well suited to its needs, and which provides ample space for considerable future growth.

No changes in personnel or in projects under way have occurred during the past year.

Research Council

The Research Council suffered the loss of Professor Toumey by death and Doctor Thatcher by resignation during 1932. H. S. Graves, Dean of the Yale School of Forestry, was the only new member appointed during the year.

The summer meeting in 1932 was held in the new quarters at New Haven. Considerable time was devoted to a discussion of the possibilities of unemployment relief thru public forestry activities and how the experiment station might be of assistance in such work. The question of federal aid to the states in forestry raised for

fresh consideration by the Copeland Resolution, was also discussed. The consensus of opinion was that the principle of federal aid is sound but the difficulty lies in setting up its limitations. The basic principle is to lay the foundation for economic development of a region and for the security of property. The suggestion was made and favorably received that more effective use of any given amount of federal aid might be attained by placing federal aid in all forestry activities on a flexible basis so that aid in any line could be discontinued or decreased when its objective had been reached in any state and money so released devoted toward stimulating activity in a new field. Thus, in the Northeastern states there is little need for further aid in forest planting and a decreasing need in fire protection. Aid could be used to advantage, however, in the development of demonstration forests or in the solution of marketing problems. On the other hand, states in other sections have great need for stimulation in planting and protection but are not yet ready for much activity along other lines.

The second day of the meeting was devoted to a field trip under the guidance of Professor R. C. Hawley, over a portion of the Eli Whitney Forest of the New Haven Water Company, where the results of various silvicultural operations could be seen.

The eighteenth meeting of the Research Council was held in Boston, Massachusetts, on February 8, 1933. A number of entomologists from the Northeastern region and Canada were present as guests during the morning session when the Committee report on the European pine shoot moth situation was the principal topic

for discussion. The report showed the insect to be rather generally distributed in western New York, in the vicinity of New York City, and thruout Connecticut. No infestation was reported from Maine, New Hampshire, or Vermont and the only point of infection reported in Massachusetts outside the Boston metropolitan district was at Williamstown on ornamental plantings. Several infestations were reported in Canada from Montreal to Ottawa with the most serious in the peninsula west of Niagara Falls. Various phases of the situation were discussed, and the Committee was continued for another year.

Director Behre made a brief statement concerning the findings of the Copeland Report. Mr. Kellogg took exception to the Forest Service interpretation of some aspects of the national forestry problem and then led the discussion into the possibility of the public regaining control of much of the privately owned virgin timber lands in the west without cost. Legislation upon which this might be accomplished is already existent in the Clarke-McNary Law.

The afternoon session was devoted to a discussion of the needs in forest fire research. A number of the state fire wardens were present to participate in this part of the program. It was generally agreed that the experiment station might well direct its attention to a comprehensive study of fire damage. General satisfaction with the fire weather charts issued by the station was expressed by some of the state men, but it was suggested that these charts would be even more useful if wind could be integrated in some way with the factors already considered and if some measure

of the effect of snowfall during the previous winter could be worked out for application to southern New England. Other suggestions covering a variety of topics related to forest fire protection which are in need of study were offered by the various speakers.

Experimental Forests

Additional progress during the past year was made in rounding out the experimental forest program. Further examinations of three areas in the Green Mountain Purchase Unit having possibilities for forest research purposes, resulted in the selection of a unit northeast of Peru which includes about 1,400 acres of land now in federal ownership. Large areas of old fields representing various periods of abandonment comprise the bulk of the unit. Intermingled, however, are tracts of culled old growth and second growth northern hardwoods as well as a considerable area of second growth spruce. These conditions meet the requirements for working out problems directly concerned with the rehabilitation of the large area of abandoned farms and intermingled woodland characteristic of the region. A preliminary survey of the unit was made last fall to determine the extent of openland and distribution of forest types. As a result of a subsequent conference with Region 7, however, action on the formal recognition of this area has been indefinitely postponed.

Certain legal aspects relating to the transfer of title have prevented consummation in 1932 of the agreement covering the Finch, Pruyn Experimental Forest in the Adirondacks. The difficulties are now in the process of being straightened out and it is expected

4

that this area will be formally recognized by the three co-operating agencies during 1933.

Additional unemployment relief money made possible the resumption of the road building program on the two experimental forests in the White Mountains the latter part of 1932. Advantage was taken of the abandonment by the Boston and Maine Railroad of their Bethlehem Junction-Franconia Notch spur to develop at a very moderate cost two miles of excellent road which traverses the swamp in the eastern portion of the Gale River Experimental Forest. Good progress has been made on the two-mile loop road on the west end of this forest and on a mile of road which will connect the loop road with the old railroad grade. Current appropriations, however, will not permit surfacing of the entire loop road. Completion of this road system will bring the bulk of the timber on the forest within a quarter of a mile of a road.

Road work is also in progress on the Bartlett Experimental Forest. Before the end of the present fiscal year an additional mile and a half of grade will be completed on the Louisville Brook loop road. Most of this road will be made passable for automobiles under ordinary weather conditions this year and the entire grade will be available for winter hauling. This will make accessible a large additional area of hardwood forest. An additional mile and one half of construction on the Bartlett-Haystack road would make the entire Bartlett Experimental Forest, excepting some of the upper slopes, less than half a mile from an automobile road. Thru the sale of cordwood over a mile of right of way on the two

forests was cleared without the expenditure of road funds.

Living conditions at the Bartlett quarters during the past year have been considerably improved thru the installation of an adequate heating system and a new connection to the town water supply which includes a fire hydrant. Plans for the development of more adequate field quarters on the forests have been drawn up.

The program for posting appropriate signs on the boundaries, roads, and permanent plots on the experimental forests was advanced during the year.

The intensive management cruises begun in 1931 were completed for both the Gale River and the Bartlett Experimental Forests in the course of the past season. On the Bartlett Forest a total of 507 plots representing a little less than five per cent of the total area has been established. Plots established on the Gale River Forest totalled 511 and represent approximately ten per cent of the area.

Approximately 100 cords of fuelwood were removed from the Bartlett Forest last year. Some of this was cut in the clearing of rights of way for new roads; some came from experimental thinning plots; and a number of sales were made in all-aged hardwood stands, decadent wolf trees making up the bulk of material removed in these cuttings. Fuelwood cutting in stands of gray birch resulted in a fair residual stand of white pine and the more valuable hardwood species. The only material removed from the Gale River Forest was approximately 30 cords of wood cut in connection with the sale of timber along the loop road survey

and approximately 5,000 feet of white pine and spruce cut from a series of thinning plots.

On the Bartlett Forest girdling of undesirable trees left after fuelwood operations of the past decade were attempted on a limited scale. Cleanings in dense stands of hardwood reproduction were also made during the past year. Both operations were made on an experimental basis with records kept of the work done. The possibilities of carrying on such work in the future have by no means been exhausted.

Use of Experimental Forests for Research Projects

The extent to which the experimental forests were used during the past year in furthering the work of the various research projects follows:

Forestation:

1. A survey was made of the Gale River Forest to determine the suitability of the open areas for planting experiments.
2. A number of temporary plots were established in the various plantations on the Gale River Forest to determine survival and growth for various species under different densities of overwood.

Mensuration:

1. In connection with the growth and yield of northern hardwoods study, a number of semi-permanent sample plots were established on the Bartlett and Gale River Experimental Forests.
2. Two plots, one treated and the other a check, were established on the Bartlett Experimental Forest to study the effects of thinning in a stand of northern hardwoods.

Management:

1. In furtherance of the spruce management study two sets of permanent plots, one a series of four methods of cutting plots in mixed spruce hardwood stands, the other a series of four thinning plots in a nearly pure pulpwood stand, were established on the Gale River Experimental Forest.

2. Two five-acre girdling plots were established on the Finch Pruyn Experimental Forest in cooperation with Finch, Pruyn and Company and Cornell University. Treatment of these plots, however, was deferred until the 1933 season.

3. Thru the assistance of Cornell University, an indicator type map was made for the Finch Pruyn Experimental Forest.

4. Also thru and from the same source, over half the management cruise plots on the Gale River Experimental Forest were classified into indicator types.

Pathology:

1. Detailed studies of heart rots in balsam were continued thru the establishment of two additional plots in a mature stand of balsam and spruce in the Finch Pruyn Experimental Forest.

Miscellaneous:

1. Meteorological records have been obtained at six stations on the experimental forests. On each forest record is maintained of conditions in the open at headquarters. In addition, a pair of stations is maintained in the forest itself in connection with the hardwood thinning experiments at Bartlett and the uncut methods of cutting plots at Cherry Mountain.

2. Special meteorological observations during the total solar eclipse of 1932 were made at the headquarters stations on both the Gale River and the Bartlett Experimental Forests.

3. A large number of management cruise plots on the Gale River and Bartlett Experimental Forests were used as a basis for determining the amount of growing stock in the spruce and northern hardwood region, the data being used in Mr. B. P. Kirkland's study of regional growing stock.

Administrative Research

The plan of work of the White Mountain National Forest organization for 1933 includes a number of new experimental projects, showing a healthy interest in research activities. On one ranger district experiments have been initiated on the possibilities of using wild seedling stock of red spruce, which can be collected very cheaply, for planting open areas. Heavy cleanings in young stands of reproduction are also being tried. Another ranger is undertaking two studies aimed at modifying or improving the composition of stands by fuelwood cuttings.

On the Green Mountain National Forest, an experimental planting to test the adaptability of various species and classes of stock to the local conditions will be set out this spring. Permanent quadrat studies will also be initiated to study the progress of natural reproduction on old fields on this forest.

Cooperation

Intimate relations have been maintained with the White Mountain National Forest in connection with a number of projects of mutual interest. In connection with the new management in-

ventory of the National Forest, the experiment station analyzed the increment data obtained in the previous season's cruise and from the experimental forests and made recommendations on limitations of sampling for the 1932 season in order to reduce the volume of work and meet reasonable standards of error. Mr. J. W. Girard of the Washington Office, spent two weeks at Laconia in January reviewing the past season's work on the survey of the White Mountain National Forest and devising an empirical method of predicting growth based upon the stand tallies and age class mapping.

A detailed memorandum of agreement covering the use of the experimental forests in the White Mountains was prepared by Mr. James E. Scott, reviewed by the experiment station, and forwarded to Washington for approval. Mr. D. W. Tabbutt spent two days in the spring of 1932 with Mr. Behre on the Green Mountain National Forest, considering the possible location of an experimental forest there.

As in 1931, the White Mountain National Forest has handled the road construction work on the experimental forests, made possible by the federal program of unemployment relief.

Cooperation with Finch, Pruyn and Company and the Cornell University Forestry Department was continued at Newcomb, New York, on a very satisfactory basis. The Cornell forestry students assisted in re-tallying the series of large methods of cutting plots. Balsam was cut from two quarter-acre plots in the study of rots, and a new pair of girdling plots was established on the proposed Finch Pruyn Experimental Forest.

In connection with the study of forest plantations the ex-

periment station received cooperation from all the state forestry departments and a number of other agencies in the region. Part of this cooperation took the form of assistance in selecting suitable areas and setting out a number of experimental plantings of Scotch pine, and part came in assisting Doctor Stewart in the study of planting operations in progress. Beside the state forestry departments should be mentioned the Department of Forestry at the University of Maine; the S. D. Warren Paper Company; Bates College Forest; the New Haven Water Company; the Harvard Forest; the White Mountain National Forest; and Mr. Ellwood Wilson, formerly of the Canada Power and Paper Corporation, Grand Mere, P. Q.

The New York State Conservation Department has offered to make a tract of several hundred acres in one of the new reforestation areas available for experimental use by the Forest Service.

The Bureau of Plant Industry, Entomology, and Biological Survey, and the Weather Bureau have continued their cooperation in the Northeast as part of the McSweeney-McNary forest research program. However, only the representative of the Bureau of Entomology is now housed with the experiment station. The representatives of the Bureau of Plant Industry have taken their offices in a building across the street where the Bureau has maintained a tree disease laboratory for several years. The representative of the Biological Survey remained in Amherst.

A brief report on the fire weather study at Petersham, Mass., was published thru the cooperation of the Massachusetts Forestry Association, and a similar report for the Smyrna Mills, Maine, station appeared recently in the Biennial Report of the Maine

Forest Commissioner. In a similar way a joint bulletin on the treatment of weeviled stands of white pine by H. J. MacAloney of the Bureau of Entomology and A. C. Cline of the Harvard Forest, was published thru the cooperation of the Connecticut Forest and Park Association.

Summary of Accomplishments

Forestation:

In the survey of existing plantations some 350 areas were studied during the 1932 season. These were well distributed over the entire region.

Ten experimental plantings of Scotch pine of special stock from Booneville, New York, were made thru cooperation of a number of agencies in the spring of 1932. These were examined and staked for future observation in the fall.

Over sixty individual planting jobs, illustrating practically all variations in organization and technique in use in the Northeast, were studied during the spring season. As a general average it was found that less than forty per cent of the trees were set at the correct depth. There seems to be a tendency to set the trees low. Further study will be needed to ascertain just how serious this is. Mortality during the first year is appreciably higher in trees set too high, very low, or loose, than in those set correctly or only slightly low. About twenty-five per cent of all the trees examined were in these classes. Seedling stock is likely to be set less accurately than transplant stock. With white pine, 2-2 transplants showed a significantly lower survival than the 2-1 stock. Norway pine seedlings did not

survive as well as transplants. There was a great variation in the speed of planting on the various jobs but this could not be definitely correlated with survival or initial growth.

Management of Spruce Hardwoods:

The past year was largely devoted to the development of the Gale River Experimental Forest, remeasurement of several series of permanent plots, and compilation of the records in the office. A series of four small plots for study of the results of experimental cuttings and another series of four plots for the study of thinning in pure softwood were established on the Gale River Forest. A pair of plots to clarify the practice of girdling of hardwoods in pulpwood forests was also established on the Finch Pruyn Experimental Forest. Observations of the past year have served to strengthen the belief that on most mixed pulpwood lands girdling should be done on a selective rather than on a broadcast basis. An understory of reproduction less than five feet tall can be given complete release without damage, but sudden exposure of spruce and fir above sapling size often results in damage by wind or in sun scald and subsequent insect injury, which can be avoided if the girdling is done selectively.

Pathology:

A large part of the past year has been devoted to a complete reorganization of the office and of the fungus collections, following the move to New Haven. Field work was concentrated on re-examination of some of the slash disposal plots in the White Mountains and gathering additional data on the rots of balsam fir in the Adirondacks.

Mensuration:

The past summer saw the completion of the intensive survey of the Bartlett Experimental Forest, being developed as a research laboratory for the management of northern hardwoods. Much basic data on tree species and size distribution and growth have been obtained during this survey. There are also available records on a number of permanent sample plots in northern hardwood stands in Vermont which cover a period of twenty five years. Two thinning plots in a yellow birch stand were established on the Bartlett Experimental Forest to study growth and deterioration of yellow birch after thinning.

The merchantable volume tables for beech, sugar maple, yellow and paper birch, and white ash, prepared in 1931 by a multiple correlation method, were checked against a series of New Hampshire data. Some differences were found and these are being analyzed to locate the source of error. Additional data from the thinning plots on the Bartlett Experimental Forest are available for further check. These data will also be used in the construction of volume tables, showing total cubic contents including volume of top and limbs.

During the past field season nearly a hundred sample plots in northern hardwood stands were measured for the study of yields and about one third of these were so located and marked as to permit remeasurement after five years. During the progress of this work an ingenious device to facilitate the measurement of growth from hardwood increment borings was devised.

Fire Protection:

During the past year reports were published, based upon the analysis of the Petersham, Massachusetts, and Smyrna Mills, Maine, ^{data from the} fire weather stations. In general, the results of the Petersham and Smyrna Mills studies substantiate the earlier findings at Cranberry Lake, New York. The evaporation rate was found to be the best single index to fuel moisture content. At both of the New England stations the psychrometric factors were found to be of greater significance than for the New York station. Because of this fact it was possible to substitute relative humidity for evaporation rate in the alignment charts for estimating duff moisture content. The other two variables used were air temperature and number of hours since last measurable precipitation.

The differences in degree of hazard and effect of weather conditions upon forest litter in the white pine and spruce-fir regions of New England were clearly brought out by the Petersham and Smyrna Mills data. The extreme porosity and thinness of the material which constitutes white pine duff make for extreme rapidity of drying. Spruce-fir duff being composed of shorter, somewhat thicker elements mats down and therefore dries out more slowly. Thus, under identical weather conditions a hazard is created much sooner in the white pine region than in the spruce-fir region. In both regions, however, the effect of the green canopy upon reducing the intensity of hazard is very great, so much so that variations in forest fire hazard in any general forest region are as much the result of variations of the degree of exposure of the fuels to weather as to the types of weather

A series of tests on grass fires with Zenith Fire Dust were made during the spring fire season of 1932. The results obtained on these fires with this chemical were extremely disappointing. In general, it was found that the fire dust was very much less effective in putting out fires than water, and ordinary fine soil is as good as the chemical.

Entomology and Biology:

Studies in the treatment of badly weeviled white pine stands have led to the significant conclusion that timely cutting of infested leaders is important not only to reduce the population of weevils but also to prevent the formation of bad crooks and forks which develop when the larvae are permitted to go thru more than a single whorl.

The population of weevils, parasites, and other insects which matured from large numbers of white pine shoots have been analyzed to establish the influence of birds upon the abundance of the weevil. In this work several species of insects, not yet identified and not previously associated with the white pine weevil, were found.

Publications:

Since the last annual report the following publications by members of the experiment station have appeared:

✓ Behre, C. E., 1932. Change in Form of Red Spruce after Logging and of Northern White Pine after Thinning. Jour. For. XXX:805-810.

✓ _____ 1932. Are Further Studies Needed on the Relation of Forests to Water Supply in New England? Jour. New England Water Works Assn. XLVI: 170-183. (Also in Water Works Engineering, March 9, 1932)

✓ Cline, A. C. and MacAloney, H. J., 1933. Additional Notes On the Improvement of Weeviled White Pine Plantations. Publication 24, Conn. Forest and Park Assn. 12 pp.

✓ MacAloney, H. J., 1932. The White Pine Weevil. U.S.D.A. Circular 321. 30 pp., 15 pl. and figs.

✓ _____ and Johnston, J. W. Jr., 1932. Weevil Does Little Damage to Riga Pine. Forest Worker, May, 1932. pp. 9.

✓ _____ 1932. White Pine Weevil Attack on Scotch Pine. Jour. For. XXXI: 26-28. (Also Northeastern Forest Experiment Station Technical Note 12.)

✓ Reineke, L. H., 1932. A Precision Dendrometer. Jour. For. XXX:692-699.

✓ _____ 1932. Comments on Winters' and Wheeler's "The Suitability of Reineke's Planimeter Method for Volume Determinations of Delta Hardwood Species." Jour. For. XXX:429-435.

✓ _____ and Bruce, D., 1932. An Alinement-Chart Method for Preparing Forest-Tree Volume Tables. U.S.D.A. Technical Bulletin 304. 28 pp., 15 figs.

✓ Spaulding, P., 1932. Pre-eradication Scouting. Stop, Look, and Listen. Proc. 17th. Ann. Blister Rust Control Conference. pp. 27-28. Mimeographed.

_____ 1932. Leigh Humboldt Pennington: 1877-1929. Phytopathology, XXII (11): 873-877.

- ✓ Stewart, G. R., 1933. A Study of Soil Changes Associated with the Transition from Fertile Hardwood Land to Pasture Types of Decreasing Fertility. Ecological Monographs, 3: 107-145, 5 figs.
- ✓ Stickel, Paul W., 1932. Review of "Aufbau, Wuchs, und Verjüngung der Südeuropäischen Urwälder: Ein waldbauliche Studie über der Urwald unserer Zone überhaupt" by Karl M. Müller. Forest Worker 8(2): 18-21.
- ✓ _____ 1932. Review of "The Burning of Settlers' Slash and Meteorological Conditions in the Province of Quebec during 1931," by L. H. Nichols. Forest Worker, 8(4): 20-21.
- ✓ _____ 1932. Weather and Forest Fire Hazard with Special Reference to the White Pine Region of Central New England. Mass. For. Assn. Bulletin 153, 8 p., 4 figs.
- ✓ _____ 1933. The Role of Silviculture in Forest Fire Control. Pulp and Paper Magazine of Canada, 34(1): 20-24, illus.
- ✓ _____ 1933. Weather and Forest Fire Hazard with Special Reference to the Spruce-Fir Region of Northern Maine. Nineteenth Biennial Report, Forest Commissioner, State of Maine, 1931-1932. pp. 118-139. illus.
- ✓ Westveld, M., 1931. Pulpwood Cutting Experiment Begun in the Adirondacks. Jour. For. XXIX: 135-136.
- ✓ _____ 1932. Releasing Merchantable Sized Spruce and Fir Through Girdling. Jour. For. XXX: 94-95.
- ✓ _____ et al., 1932. The Improvement of Composition of Stands in New England. Jour. For. XXX: 670-673.

The following manuscripts are to be published or completed for publication during the fiscal year 1934.

Behre, C. E. Experiments on Factors Affecting Distribution of Wood in Coniferous Stems. Estimated 20 typed pages, 4 tables, 6 figures. For the Journal of Forestry.

Statistical Studies of Factors involved in the Application of Form Class Volume Tables. Estimated 60 typed pages, 16 tables, 10 figures. For Journal of Agricultural Research.

and Reineke, L. H. Volume Tables for Northern Hardwoods. Estimated 16 pages, 12 tables. Either for special publication, U.S.D.A., or for Journal of Forestry.

Cline, A. C. and Macaloney, H. J. Observations on Plots Studied in Connection with the Reclamation of Severely Weeviled White Pine Plantation. Estimated 10 typed pages.

Macaloney, H. J. The Relation of Weather Conditions to Hibernation and Larval Activity of the White Pine Weevil. For Journal of Forestry. Estimated 4 typed pages.

Experiments on the Control of the Mound Building Ant. Estimated 10 typed pages.

Reineke, L. H. Perfecting a Stand-Density Index for Even-Aged Forests. Accepted by Journal of Agricultural Research.

Principles of Quadrat Sampling in Silvical Studies. For Journal of Forestry.

A Movable Mapboard for Fire Lookouts. For Journal of Forestry.

An Instrument for Holding, Slicing, and Measuring Hardwood Increment Cores.

Spaulding, P. Dietrich Preferable Authority for Cronartium ribicola. Phytopathology, 23: 203-204. Feb. 1933.

Review of E. E. Hubert's "Outline of Forest Pathology." Accepted by Journal of Forestry.

Stewart, G. R. A Survey of Forest Planting in the Northeast. Estimated 24 printed pages, 6 tables, 6 illus. For U.S.D.A. Circular, summer of 1933.

Stickel, Paul W. Observations on Drought Injury in Hemlock-Hardwood stands on Trap Rock Ridges near New Haven, Conn. Typed 8 pages. Accepted by Journal of Forestry.

Experiments with Calcium Chloride as a Forest Fire Retardant. Typed 21 pages, 4 figures. Accepted by Journal of Forestry.

Review of "Vergleichende Untersuchungen der Ertragsleistung reiner Kiefern - Stangenhölzen nach Kahlschlag und reiner Kiefern - Althölzer aus Naturverjungen unter Schirm." By Karl Hennecke. Zeit für Forst. -u. Jagdwesen. 64(7): 365-411 and 64(8): 449-468. 1932. Accepted by Journal of Forestry.

Review of "Über den Einfluss des Kahlschlages auf den Verlauf der biologischen und biochemischen Prozess im Waldboden." By L. G. Romell. Forst. Wochenschrift Silva. 20(18): 1-5, 1932. Accepted by Journal of Forestry.

Weather and Forest Fire Hazard with Special Reference to the Upper Altitudinal Spruce-Fir Region of Northern New York. Estimated 10 pages, 3 figures. To be submitted to the New York State Conservation Department.

Weather and Forest Fire Hazard in the Northeastern United States. To be ready late summer or early fall of 1933. Estimated 30 pages, 10 figures. To be submitted for U.S.D.A. Technical Bulletin or Circular.

Translation of "Studien über Natürliche Humusformen" (Studies of Natural Humus Forms) by P. E. Müller. To be ready late 1933 or early 1934. Estimated 300 typed pages.

Effect of Forest Cover on Evaporation, Interception of Precipitation, and other Factors in the Northeast. Estimated 12 pages. For Journal of Forestry, Journal of New England Water Works Assn., or similar periodical.

Westveld, M. Results of Experiments on the Release of Immature Spruce and Fir by Girdling of Hardwoods. Estimated 25 typed pages, 18 tables, 3 figs. For Journal of Agricultural Research or U.S.D.A. Circular.

Growth on Cut-over Pulpwood Lands. Estimated 20 printed pages, 10 tables, 10 figures. For U.S.D.A. Technical Bulletin, late 1933.

et al. Experimental Cutting of Spruce and Fir in the Adirondacks. 24 typed pages, 6 tables, 1 figure. For Journal of Forestry.

Northeastern Forest Experiment Station

Budget by Projects

Estimate Fiscal Year 1933

Sub-Appropriations
and Projects

Research Allotment

Forest Management

Bp	\$ 150
F-1	13,600
M-1	12,150
ME-1	1,450
ME-2	750
ME-3	12,200
Pf-2	1,700
Pf-3	<u>5,200</u>
Total	\$ 47,200

Note: No other appropriations or contributions.

Northeastern Forest Experiment Station

Budget Allotment Sheet

Fiscal Year 1934

Position	Name	Salary	Period Employment	Forest Management Allotment	
				Salary	Expenses
Director	Behre	\$4,600	12 months	\$4,600	\$ 570
Sr. For. Ec.	Stewart	5,000	"	5,000	525
Silvest.	Westveld	4,000	"	4,000	500
Asso. Silvest.	Stickel	3,200	"	3,200	520
" "	Reineke	3,200	"	3,200	480
Asst. Silvest.	Jensen	2,700	"	2,700	750
Jr. For.	Morey	2,000	"	2,000	500
" "	Blythe	2,000	"	2,000	200
Sr. Clerk	Turrell	2,400	"	2,400	
Asst. Clerk	Scott	1,680	"	1,680	
" "	Heaphy	1,620	6 months	810	
Jr. Clerk	Weldon	1,680	12 "	1,680	
Comp. Clerk	Martin	1,740	"	1,740	
Total				\$ 35,010	\$ 4,045

Miscellaneous Expenses

Salaries - Field Assistants	\$ 1,355
Travel " "	1,190
Purchase - Cars	950
Maintenance - Cars	350
Supplies and equipment	1,000
Rent, Heat, Light, Power	2,000
Telegraph, Telephone, Postage	200
Freight, Express, Drayage	100
Improvements and Miscellaneous	1,000
Total	\$ 8,145

Northeastern Forest Experiment Station

Estimated Distribution of Direct

and Overhead Expenditures

Fiscal Year 1934

<u>Sub-Appropriation</u>	<u>Direct</u>	<u>Overhead</u>	<u>Total</u>
Forest Management	\$34,420	\$ 12,780	\$ 47,200

INDEX TO PROJECT STATEMENTS

<u>Major Projects</u>	<u>Page</u>
F-1 Forest Planting in the Northeast. (Stewart, Morey)	25
M-1 Management of Spruce Hardwoods. (Westveld)	28
ME-1 Development of Universal Taper and Volume Tables (Behre)	34
ME-3 Growth and Yield of Northern Hardwoods. (Reineke, Jensen)	36
Pf-2 Forest Fire Behavior. (Stickel, Reed)	39
Pf-3 Forest Fire Damage. (Stickel)	44
Pd-7 Rots of Balsam Fir Pulpwood Timber. (Spaulding)	46
Pl-4 Control of the White Pine Weevil. (MacAloney)	50
Biology Relation of Birds and Mammals to the White Pine Weevil and the White Pine Blister Rust. (Miller)	53
<u>Minor Projects</u>	
Bp Phenological Observations of Forest Vegetation in the Northeast. (Morey)	55
M-2 Management of Central Hardwoods. (Westveld, Jensen)	57
M-3 Growth, Development, and Management of Northern Pine and Hemlock. (Jensen, Stickel, Behre)	59
ME-3 Growth and Yield of Spruce and Balsam Fir. (Reineke)	60
Pf-1 Forest Fire Attack. (Stickel)	61
Pd-1 Chestnut Blight. (Spaulding)	63
Pd-2 White Pine Blister Rust. (Spaulding)	65
Pd-5 Shade and Ornamental Tree Diseases. (Spaulding)	66
Pd-6 Miscellaneous Forest Tree Diseases. (Spaulding)	67
Pd-8 Heart Rots of Northern Hardwoods. (Spaulding)	69
Pl-7 Miscellaneous Forest and Shade Tree Insects. (MacAloney)	71

FORESTATION

Project

Forest planting in the Northeast. (F-1)

Scope

To work out an adequate scientific basis for forest planting in the Northeast with due consideration of the necessary economic limitations. Special emphasis is being given to a study of the factors which determine the suitability of a species for a particular site.

Status

The work of the first season in 1931 was devoted to a preliminary survey of the state of existing good and poor forest plantations in the Northeast. During 1932 this work has been continued. In addition studies were made in five states of the region on planting technique and planting costs. On each planting job visited staked rows were set out as basis for detailed record of depth of setting, vigor of plant, survival, and growth. Arrangements have been made in New York State with the Conservation Department and in Connecticut with the New Haven Water Company for the use of land for planting experiments in the spring of 1933.

With special stock of known origin from Booneville, N. Y., furnished by the New York Conservation Department, small plantings to determine adaptability of the species to varying conditions in the Northeast were established at ten places in New England. Four similar plantings were made in New York by the Conservation Department.

(F-1)

Results

During 1932 some 350 plantings were measured in the course of the plantation survey. These plantings were located largely in Maine, New Hampshire, and New York State. A small number of plots were examined on the lands of the Laurentide Paper Company near Grand Mere, Canada. The results of the two seasons' survey are being summarized during the winter of 1932-1933.

A report of the planting and survival of the Booneville Scotch pine stock has been distributed to the cooperating agencies.

A progress report on the study of planting technique and costs shows that there is a general tendency to set trees too low and that mortality at the end of the first year is appreciably higher when trees are set very low, too high, or loosely, than when they are set correctly or only slightly low. It also appears that seedling stock, especially of red pine, is set less accurately than transplant stock. With white pine the mortality of 2-2 transplants averaged significantly higher than with either 2-1 transplants or seedlings. Some preliminary work was done on the influence of the method of planting nursery stock on its subsequent root development. Comparisons were made of the early root development of natural seedlings of white pine, Norway pine, and white spruce, contrasted with plantation trees grown from nursery stock.

Measurements were made of the Scotch pine seed source plots on Mount Toby, Massachusetts.

Plans

Continuation of work with Booneville Scotch pine. Examination of the 1932 plantings will be made in 1933, but additional plantings will not be made until the spring of 1934. Completion of arrangements with Lake States Forest Experiment Station for cooperative plantings in the spring of 1934 of Norway pine of known seed source at several points in the Northeast.

Experimental plantings to be made in cooperation with New York State Conservation Department and the New Haven Water Company to attempt to determine the effect of the method of planting upon the root development of the more important conifers.

Further comparison of the root development of natural seedlings with those of trees grown from nursery stock. Particular attention will be given to the effect of the soil profile on the root form.

Continuation of the plantation survey with the study of a limited number of representative plantings, such as those made on the New York City Watersheds.

Assignment

Guy R. Stewart and H. F. Morey.

MANAGEMENT

Project

Management of spruce-hardwoods. (M-1)

Scope

To determine the best methods for increasing the productivity of existing stands in the various spruce types of the region. The project includes studies in (1) methods of cutting; (2) natural reproduction; (3) girdling; (4) weeding; (5) thinning; (6) slash disposal; (7) forest soil types; (8) management problems on the Gale River Experimental Forest.

Status

Approximately 420 temporary plots, aggregating about 70 acres, representing a wide variety in age of cutting and stand composition, and 182 permanent plots totaling 273 acres established in representative spruce types of the region, form the basis of the study. The distribution of the permanent plots among the various phases of the study is as follows:

<u>Phase of Study</u>	<u>No. of Plots</u>	<u>Area in Acres</u>
Methods of cutting	138	190.73
Girdling	13	45.25
Weeding	10	3.25
Thinning	7	2.50
Slash disposal	14	31.95
Total	182	273.68

On many of the permanent plots studies of soil and natural reproduction are being conducted. Of the ten new plots established during the past year, 8 are located on the Gale River Experimental Forest and 2 on the Finch Pruyn Experimental Forest.

Progress for 1932

A new set, the four quarter-acre thinning plots, was established on the Gale River Forest. Different degrees of thinning reduced the basal areas to the following amounts: Plot B - 25 square feet, Plot D - 30 square feet, Plot A - 35 square feet, and Check Plot C - 42 square feet. The practice will be to cut these plots lightly but frequently on the theory that sufficient growing stock can be left which combined with rapid growth will justify commercial operations at relatively short periods. The series should show which degree of thinning will give the maximum yield, over a long period of years.

Also on the Gale River Forest a series of 4 method of cutting plots was established. The purpose of these plots is to determine the feasibility of increasing the proportion of spruce through removal of competing species. On one plot only balsam fir was removed; on the remaining three, in addition to balsam, all hardwoods were removed leaving only spruce and white pine to form the residual stand. It is believed that certain of the types of cutting employed on both the thinning and method of cutting plots have wide application in second growth stands throughout the spruce region.

Progress toward clarifying the practice of girdling as an essential part of good management in the mixed spruce-hardwood stands of the Adirondacks is being accomplished through the establishment of a set of girdling plots in typical spruce types on the Finch Pruyn Experimental Forest at Newcomb, N. Y. Cornell University and Finch, Pruyn and Company are cooperating in the experiment. An advisory

committee of prominent New York lumbermen and pulp and paper men will be appointed to carefully examine the areas and decide which shall be girdled and which shall be held as a control. On the committee will be men who are known to be opposed to girdling as well as men who favor the practice. The results of the experiment will thus be entirely freed from personal bias. The experiment should pave the way for a more intelligent understanding of the entire girdling problem as related to the management of spruce lands in the Adirondacks.

Through the assistance of Cornell University an indicator type map for the Finch Pruyn Experimental Forest was made last summer. Aid from the same source was responsible for the classification into indicator types of over half the management cruise plots located on the Gale River Forest. Approximately 150 of these plots were used as a basis for determining the amount of growing stock in the important spruce types of the region in response to a request by Mr. Kirkland for data of this character.

A considerable amount of plot remeasurement work was accomplished during the season. A set of seven method of cutting plots of the old Forest Service series of 1906 were remeasured in the high spruce slope country on Killington Mountain in Vermont. Five even-aged spruce growth plots, 2 method of cutting plots, and 3 weeding plots all located on the Battell Forest in Vermont as well as a series of 3 spruce slash plots on the L. R. Jones State Forest in Vermont were remeasured. The girdling plot at Bolton, Vermont, was remeasured in the spring of 1932. A complete stand tally of the

three cut-over 23-acre plots in the Finch Pruyn series of method of cutting plots was made with the assistance of the students attending the Cornell Forestry School Camp. A set of 4 weeding plots located at Cherry Mountain, N. H., were remeasured during the season. Eleven additional temporary plots established in 1925 in Maine and New Hampshire were remeasured and added to the list of permanent plots.

Readings on the two meteorological stations at Cherry Mountain and one at Gale River were maintained during the season. Tallies were also kept up to date on the seed bed condition plots at Cherry Mountain and an additional series was laid out late in the fall.

Reports :

Westveld, M. Pulpwood Cutting Experiment Begun in the Adirondacks.

Journal of Forestry, Vol. 29, p. 135-136.

Comments on "The Burning of Settlers Slash and Meteorological Conditions in the Province of Quebec during 1931" by L. H. Nichols. Memorandum 2 pp. Jan. 1932.

Releasing Merchantable Sized Spruce and Fir Through Girdling. Journal of Forestry, Vol. 30, pp. 94-95, 1932.

New England Section

Committee Report. The Improvement of Composition of Stands in New England. Jour. of For. Vol. 30, pp. 670-673. 1932.

Plans

With the management cruise of the Gale River Forest now completed the basic data obtained is being compiled as basis for orienting future experimental work on the Forest.

(M-1)

The following permanent sample plots come up for re-measurement this year:

Plot No.	Locality	Acreage	Date Est.	Date for Remeasurement
<u>Methods of Cutting Plots</u>				
92-93	Waterville, N.H.	1.0	1928	1933
<u>Girdling Plots</u>				
38	Bolton, Vt.	1.0	1931	1933
61	Newcomb, N. Y.	28.0	1930	1933
67	Finch Pruyn Forest, N. Y.	5.0	1932	1933
68	" "	5.0	1932	1933
<u>Weeding Plots</u>				
72-74	Waterville, N. H.	0.75	1928	1933
<u>Slash Disposal Plots</u>				
75-77	Waterville, N. H.	6.0	1928	1933
<u>Spruce Growth Plots</u>				
81-91	Gale River Forest, N.Y.	1.62	1928	1933

Students of the Department of Forestry at Cornell University will assist in the work scheduled on the Finch Pruyn Experimental Forest and the plots located at Newcomb, N. Y. The work of relocating and remeasuring additional temporary plots established in 1924 and 1925 will be continued.

Tallies of reproduction on seed bed condition plots will be continued and additional ones will be laid out. The meteorological stations at Cherry Mountain and Gale River will be continued.

(M-1)

An attempt will be made to thin the group of plots located in the pure spruce stand in Cherry Mountain through a sale of pulpwood. It is also planned to girdle two 5-acre plots in the series of method of cutting plots established in Cherry Mountain in 1930. One plot lies in the yellow birch-red spruce type, the other in the red spruce-sugar maple-beech type. In the office attention will be concentrated on completion of publication of a report on the growth on cut-over lands in the important spruce types.

Assignment

M. Westveld, R. H. Blythe, Jr., Perley Spaulding, and Dorothy E. Martin.

MENSURATION

Project

Development of Universal Taper and Volume Tables. (ME-1)

Scope

To study the characteristic stem form of various species in order to develop the possibilities of improving and simplifying the technique of estimating contents of standing trees by the use of universal or general taper curves and volume tables. Attention has been given to the following lines :

1. Conformity of various species to a form equation.
2. Improvement of technique for preparing volume tables by the form class taper curve method.
3. Fundamental principles of tree growth.
4. Factors affecting average form of stands.
5. Factors affecting butt swell and bark thickness.
6. Comparative form of species in mixture.
7. Change in form of residual trees after logging.
8. Application of universal taper and volume tables to certain species.

Status

Results under Objective 1 with some suggestions under Objective 2 have been completed and published. Observations of the six trees being studied under Objective 3 will be continued periodically.

The Copeland Report precluded completion of the report of

(ME-1)

work under Objectives 4, 5, and 6 in 1932. Results under Objective 7 have been published. No detailed work is in progress under Objective 8.

Results and Progress for 1932

Results are as previously reported. Little progress was made in 1932 because of interruption of regular program.

Publications:

Behre, C. E. Change in Form of Red Spruce after Logging and of Northern White Pine after Thinning. Jour. For. XXX, pp. 805-810, 1932.

Plans

Completion of report covering Objectives 4, 5, and 6. Analysis of 5 years' growth of trees under Objective 3, and preparation of progress report.

Assignment

C. Edward Behre.

MENSURATION

Project

Growth and yield of northern hardwoods. (ME-3)

Scope

To determine rate of growth and yield of northern hardwoods in different forest types and methods of management which will produce maximum growth.

Status

Much basic data for this project were accumulated in the intensive survey of the Bartlett Experimental Forest. Continuous observations of meteorological conditions affecting growth, at three stations on the Bartlett Experimental Forest established during the summer of 1931, are being continued. Two of the proposed thinning plots in yellow birch stands have been established, one a check plot, the other a heavily thinned. The products of thinning were sold as fuelwood and, as in the past, fuelwood has been sold from the Bartlett Experimental Forest to round out cut-over areas and dispose of material cut from new road right of ways.

New volume tables of merchantable content are available, and have been put into use by the White Mountain National Forest.

These tables have not been thoroughly checked as yet, but two groups of tree measurements, totaling about 350 trees, are available for this purpose. These measurements are suitable for the construction of volume tables of cubic-foot content, with additional data as to volume of tops and limbs. Records covering 25 years on permanent sample plots at Pomfret, Vt., Sharon, Vt., West Rochester,

Vt., and Corbin Park, N. H., are available for analysis. Fifteen years' growth records on permanent plots at North Berwick, Me., are also at hand.

Progress for 1932

Field work of the intensive survey of the Bartlett Experimental Forest is completed. A check of the new volume tables was made; the tables failed to check as closely as desired. An analysis of the data to locate the source of the errors is in progress.

Two thinning plots in a yellow birch stand on the Bartlett Experimental Forest were established, one as a check, the other thinned heavily though less severely than in the ordinary commercial fuelwood operation. Measurements were made of stem, top and limbs of a hundred of the trees removed in thinning. These measurements will be used as a further check on the new volume tables.

For the study of yield, 97 sample plots were measured during the past field season. Of these, 37 were intensive plots, on which data as to merchantability, form, defect, and rot were secured. Wherever possible, the plots were accurately located and marked to permit re-measurement five years hence.

An analysis of growth data from the Bartlett Experimental Forest Survey and from the White Mountain National Forest Survey was made to determine the accuracy of the field work and to control the amount of data collected.

An instrument for holding and slicing of hardwood increment cores was developed which facilitates the counting and measuring of such cords without the aid of dyes or stains.

Plans for Fiscal Year 1934

Merchantable volume tables will be further checked and corrected, and tables will be prepared for total content in cubic feet. The volume data will be analyzed in an effort to combine two or more species into general tables.

Available permanent sample plot growth data will be worked up and progress reports prepared.

Stand tallies from intensive survey of Bartlett Experimental Forest will be analyzed as first step in developing method of yield prediction.

Measurement of selected stands throughout the region for further study of yield will be continued.

Meteorological records on the yellow birch thinning plots will be continued during the growing season. Additional plots will be established.

Data from the intensive survey of the Bartlett Experimental Forest will be worked up. A relief map of this area, showing types, improvements, etc., will be prepared.

Assignment

L. H. Reineke, Victor S. Jensen.

PROTECTION

Project

Forest Fire Behavior. (Pf-2)

Scope

The two major lines of investigation included under this project are:

(a) Study of weather and fuel relationships through instrumentation in order to determine what constitutes forest fire-weather so that the varying degrees of fire hazard can be recognized.

(b) Study of the prediction of forest fire-weather so that methods of forecasting the occurrence of dangerous periods of weather can be worked out more accurately and for longer periods in advance than is now possible.

Status

(a) Since the closing down of the Smyrna Mills, Me., fire-weather station in 1930, no active field work has been done on this phase of the fire behavior study. The report of the fire-weather study conducted at Cranberry Lake, N. Y., during 1925-1929 in co-operation with the New York State College of Forestry, appeared as a technical bulletin of that institution in December 1931. The fire-weather data obtained at Petersham, Mass. (1926-1930) and Smyrna Mills, Me. (1927-1930) have been analyzed completely. The former station was maintained in cooperation with the Harvard Forest, the latter in cooperation with the Maine Forest Service. The analysis of data from a fourth station at Elk Lake, N. Y., which was maintained from 1927-

(Pf-2)

1930 in cooperation with the New York State Conservation Department and Finch, Pruyn and Company, is nearing completion.

With the release of duff hygrometers from the fire-weather stations, a limited number of these instruments are calibrated each year and supplied to key men of the state forest fire organizations in New York and Massachusetts.

(b) Approximately twenty-five special fire-weather stations are now furnishing reports from various points in New England to the Weather Bureau office in Boston. Fire-weather stations in New York report to the Weather Bureau office in Albany. These reports are used in conjunction with the regular and special reports forecasts issued from the Albany and Boston offices. New York, Maine, New Hampshire, and the White Mountain National Forest are furnished fire-weather forecasts regularly throughout the fire season.

Results

(a) The final reports of the Petersham and Smyrna Mills fire-weather investigations were completed during the last half of 1932. For Petersham, two manuscripts were prepared, the first a technical report and the second a more popular summary intended for field men. The Smyrna Mills report followed very closely the second of the two Petersham reports.

In general, the results of the Petersham and Smyrna Mills studies substantiate the earlier conclusions of Cranberry Lake data. For the pine type at Petersham and the spruce-fir type at Smyrna Mills it was possible to construct alinement charts for duff moisture

estimates based upon observations of relative humidity, air temperature, and number of hours since last measurable precipitation. Although the substitution of relative humidity for evaporation rate - which has consistently shown itself to be the one factor of greatest importance - resulted in a slight decrease in the accuracy of the estimates of duff moisture content, this loss in accuracy is more than compensated by the fact that the factors selected will be more practical for use by the average fire warden and other field men.

As in the past, calibrated duff hygrometers were supplied to key men in the state forest fire protection organizations in New York and Massachusetts. A fairly wide distribution was made of the Petersham alignment charts to the state forest organizations of New York and New England.

During the past year the following manuscripts dealing with forest fire-weather were prepared.

Stickel, Paul W. July, 1932. Weather and Forest Fire Hazard in the White Pine Type of Central New England. Typed 107 p., 21 figs. Submitted to the Harvard Forest for publication.

Aug. 1932. Weather and Forest Fire Hazard with Special Reference to the White Pine Region of Central New England. Mass. For. Asso., Bul. No. 153, 8 p., 4 figs.

Aug. 1932. The Role of Silviculture in Forest Fire Control. Typed 20 p., 3 figs. The Pulp and Paper

Magazine of Canada. 34(1):p. 20-24, illus. 1933.

Stickel, Paul W. Nov. 1932. Weather and Forest Fire Hazard with Special Reference to the Spruce-Fir Region of Northern Maine. Typed 28 p., 7 figs. Appendix to the 19th Biennial Report of the Maine Forest Commissioner, illus. 1933.

Dec. 1932. Forest Fire-Weather. Typed 4 p. Report to the Forest Fire Committee of the New England Section of the Society of American Foresters.

(b) The regular forecasts and warning service of the past was maintained during the past year. The special daily distribution of fire-weather forecasts over radio stations WBZ and WBZA was also continued as was the dissemination of forecasts and warnings by the press, telegraph, telephone, and weather maps. In cooperation with the Massachusetts Department of Conservation a special study was completed for that state of the relationship between fire occurrence and weather conditions during 1930.

Plans for Fiscal Year 1934

A report on the Elk Lake fire-weather data, just completed, terminates the work of the four individual fire-weather stations. A semi-technical bulletin dealing with forest fire-weather in the Northeast will be prepared for departmental publication. The meteorological data will also be used for a short article showing the effect of forest cover on interception of precipitation and evaporation.

At the request of some of the state forest fire wardens, an

(Pf-2)

attempt will be made to integrate wind and snowfall of previous winter
the
with/other weather elements for a more complete evaluation of current
forest fire hazards.

(b) Routine fire-weather forecast and warning service will
be continued. As far as funds will permit the summarization of in-
dividual state fire weather records will be continued and made avail-
able to the state forestry departments.

Assignment

(a) P. W. Stickel in charge, assisted by Mary C. Weldon, in
cooperation with the Harvard Forest, the New York State Conservation
Commission, the Maine Forest Service, and the U. S. Weather Bureau.

(b) T. E. Need, Weather Bureau, in charge, in cooperation
with the state foresters of New England and the White Mountain
National Forest.

PROTECTION

Project

Forest Fire Damage (Pf-5)

Scope

To study the influence of forest fires upon standing timber, reproduction, and site for the purpose of standardizing methods of appraising forest fire damage, and for the purpose of furnishing basic information pertinent to the restoration and management of fire damaged areas.

Status

New project.

Plans for Fiscal Year 1934

Because of the many ramifications of this investigation it will be impractical to draw up at the outset a complete working plan. To orient the work, however, a comprehensive working outline for the project as a whole will be prepared. Detailed working plans for each specific phase of the general problem will be worked out as needed. A working plan for the study of basal wounding by fire - the first specific field in which work will be undertaken - will be drawn up early in 1933.

Field work for the coming year will be concentrated upon the following three problems:

- a. Initial work on the study of basal injuries.
- b. Examination and possible detailed study of records and area of the Finch Pruyn and Company 1932 fire in the Adirondack Mountains, New York.

c. Exploration of possibilities in the study of old burns about which some records are available in the State Forestry Departments.

Assignment

P. W. Stickel, in charge, in cooperation with interested agencies.

PROTECTION

Project

Rots in balsam fir pulpwood timber (Pd-7)

Scope

To determine the progress of decay in standing pulpwood timber as the basis for management to utilize all the balsam fir which the land produced and to avoid the usual waste from wind-fall and decay.

Status

Under the usual methods of operation in the spruce and fir forests of the Northeast all merchantable softwoods are removed. This leaves so little advance growth that a period of at least fifty or sixty years must elapse before another cut can be made on the same area. But before the end of this period much advance growth of balsam has grown to merchantable size, become infected with decay, and blown down by the wind.

Silvical study is now being given to the possibility of a system of partial cutting which will permit successive cuts on the same area at intervals of from 25 to 35 years, in the hope that most of the waste will be thus avoided. Concurrent pathological studies to determine relative frequency of various fungi, methods of infection, rate of spread, and conditions under which trees are most subject to infection are needed.

Sometime before 1924 studies of this sort were begun in Canada. Intensive analyses of rot conditions in two typical balsam stands, supplemented by prolonged cultural study of the rots

involved, were made. Similar work is necessary to determine the progress of decay under conditions found in the northeastern United States.

Results

Three rots have been found to cause most of the loss in balsam fir. Two are butt rots, one brown "charcoal" rot caused by Polyporus balsameus, and a stringy rot caused by Poria subacida. A third rot occurs in the upper and middle trunk and is commonly known as red heart. It is caused by Stereum sanguinolentum. There were a few scattering cases of infection by some of the common saprophytic wood-rotting fungi and some damage by carpenter ants. The following table gives the relative importance of these agencies at Gale River:

Cull Percentage by Causal Agents
Based on Merchantable Volume, 409 Trees

Causal Agent	Cull Per Cent	Per cent of Trees Affected
Butt Rots	4.5	41.8
Red Heart	2.9	7.1
Miscellaneous Rots	.2	.5
Ants	.3*	3.0
Total	7.9	47.9**

*Cull cases produced by ants and butt rot together are included in the butt rot cull per cent.

** 12 trees had both top rot and butt rot in them, and 6 trees had both ants and butt rot in them.

Decay was found to be correlated with age but not with diameter or vigor of the trees. On poorer sites the stand is breaking over to a considerable degree from the weakening of the

trees by butt rots, indicating the need for early harvesting to prevent rather heavy loss.

Progress for 1932

Two one-quarter acre plots of mature balsam fir were cut and examined for decay at Newcomb, N. Y. The three rots found in this species in New Hampshire were found to be causing loss here also. There were but two trees with ants. Several trees were killed by lightning and several by porcupines.

Reports:

Spaulding, Parley and G. H. Hepting. One sheet of tables based on the Cherry Mountain plot showing total cull by the various principal agents and relation of age to decay. Typewritten. September 1931.

Investigations in decays of

balsam fir I. Gale River Experimental Forest, New Hampshire. Typewritten, pp. 38. 1931.

Plans

Studies along the following lines will be continued as far as possible on the areas under intensive silvical study in the White Mountains, New Hampshire, and in the Adirondacks of New York:

1. Reconnaissance of types of rot, their prevalence and external symptoms.
2. Detailed examination and dissection of diseased trees on selected areas. Determination of cull per cent, age, and condition of tree, symptoms of disease, etc.

(Pd-7)

3. Culture work on the different x ts to help in checking their identity.

Assignment

Bureau of Plant Industry, Perley Spaulding.

PROTECTION

Project

Control of the White Pine Weevil. (P1-4)

Scope

To determine practical and effective measures for the control of the white pine weevil and for minimizing the damage caused by attacks.

Status

This project was begun in May 1925. Much of the work has been completed and published, particularly that referring to life history and habits. The examination of the permanent sample plots is to be continued indefinitely. Plots involving the study of new theories with respect to control of the insect and the minimization of the injury have been laid out and will be studied intensively. A report on the effect of weather conditions on hibernation and larval activity is being prepared.

Results

Study of the permanent sample plot data still bears out the fact that white pine growing in mixture with species not liable to attack is less likely to be attacked. Particularly is this the case when the associated species are older and taller. Study of the Reclamation Plots shows the advisability of using this method for improving severely weeviled stands.

Progress for 1932

All the permanent sample plots are now renumbered and boundary lines permanently established. Examination of the

Reclamation Plots showed that the pruned trees have put on increased growth and improved their position in the crown canopy since the first operation while the majority of the girdled trees have died. The remaining girdled trees will probably die in 1933. Examination of plantations of Scotch pine substantiated the findings of the previous season that certain strains are able to withstand attacks by the weevil. In cooperation with Mr. A. C. Cline, Harvard Forest, the problem of direct control by removal of infested tips was thoroughly studied. Previously this method was considered solely from the standpoint of reduction of weevil population, but when the probable improvement of the stand is considered, an entirely new aspect of the situation is presented. With this in mind sample plots were laid out and studied, data were collected, and a bulletin has been prepared and published by the Connecticut Forest and Park Association. Preliminary work on the fertilization of white pine plantations was begun in cooperation with Dr. Gast, Harvard Forest. This study was initiated in order to see if the added fertilizer would make the trees so vigorous that the attacks by the weevil would not succeed.

Publications and Reports

Macaloney, H. J. The White Pine Weevil. 30 pp., 15 plates and graphs.

Bibliography. Circular 221, U. S. Department of Agriculture. May, 1932.

and Johnston, J. W. White Pine Weevil Attack on Scotch Pine. 3 pp., 2 tables. Journal of Forestry, XXXI: 26-28.

MacAloney, H. J. and Johnston, J. W. Weevil Does Little Damage to
Riga Pine. Forest Worker, p. 9, May 1932.

Cline, A. C., and MacAloney, H. J. Additional Notes on the Improve-
ment of Weeviled White Pine Plantations. 11 pages,
3 plates, 5 tables. Publication 24. Connecticut
Forest and Park Association. January 1933.

MacAloney, H. J., and Johnston, J. W. White Pine Weevil Attack on
Scotch Pine. Technical Note No. 12. Mimeographed.
Northeastern Forest Experiment Station. 1 page.
March 15, 1932.

Plans for Fiscal Year 1934

A report on The Relation of Weather Conditions to Hibernation
and Larval Activity of the White Pine Weevil will be submitted for
publication.

Continuation of the examination of permanent sample plots.
The Reclamation plots will be re-examined, more pruning will be done
on the trees already pruned, and additional trees will be girdled
where necessary. A report will be prepared in cooperation with Mr.
Cline after the growing season of 1933. More work will be done on
the improvement of stands through the removal of infested tips. It
is probable that some more work may be done in cooperation with Dr.
Cast on the fertilization of white pine plantations.

Assignment

H. J. MacAloney, Bureau of Entomology, in cooperation with
the Harvard Forest, the New York State College of Forestry, ~~and the~~
~~Massachusetts Conservation Commission.~~

PROTECTION

Project

Relation of birds and mammals to the white pine weevil and the white pine blister rust.

Scope

Study of the relation of birds and other animals through their food habits to the white pine weevil, the white pine blister rust, and in general to the welfare of the forests.

Status

General study has been given to the character and abundance of the population of birds and rodents in the various types of forest where white pine occurs.

During the season of 1932 the major effort was directed toward an effort to determine if possible the effectiveness of birds feeding on weeviled leaders of white pine.

No specific study offering promise of being of value in the blister rust problem has been conceived.

Results and Progress for 1932

A report on the effect of birds feeding on weeviled leaders of white pine is in preparation. Random samples of leaders showing bird work were caged in comparison with similarly caged leaders untouched by birds. The broods of insects maturing from these paired samples have been counted and studied.

Plans for Fiscal Year 1934

Completion of the report on relation of birds to weevil plantations.

The preparation of a report in cooperation with the Division of Forest Insects which will deal with the entomological factors developed incidental to the study of bird work.

A consideration of the possibilities of a project dealing primarily with the management of game birds and game animals on forest areas.

Assignment

J. Paul Miller, Biological Survey.

BOTANY

Project

Phenological observations of forest vegetation in the Northeast. (Bp)

Scope

(a) To correlate observations of the leafing, flowering, and fruiting habits of trees, shrubs, and herbaceous vegetation with such natural phenomena as forest fires, the emergence of insects, and the fruiting of fungi, which are considered as important operating factors in all phases of forestry work.

(b) Since physiological functions of plant life are directly dependent upon variation of climatic conditions, the phenological observations will be correlated with meteorological records wherever possible.

Status

(a) Since 1930, when the phenological project was initiated, 18 individuals and institutions have been cooperating in securing data on the leafing, flowering, and fruiting of selected forest vegetation. At the close of each year the cooperators forward their data to the station for filing and summarization.

(b) Year-long evaporation records from Bates evaporimeters by 10-day intervals for each month were secured at Amherst, Mass., from 1927 to June, 1932. Since the summer of 1931 complete meteorological records have been obtained at the Gale River and Bartlett Experimental Forests in the White Mountains.

(Bp)

Results

(a) During the past year field work was continued with the aid of 18 interested cooperators. A brief progress report covering the first two years of the project was distributed to the various cooperators and other interested parties. A small amount of the data was summarized, but no significant results were obtained due to the short period during which the project has been carried.

Plans for Fiscal Year 1934

(a) Phenological data will be secured from the present cooperators and cooperation will be sought from other individuals who may be interested in this type of work. As opportunity presents itself, cooperators will be contacted from time to time. No further effort to summarize the data will be made before 1935.

(b) The meteorological stations on the Experimental Forests in the White Mountains will be continued.

Assignment

H. F. Morey and R. H. Slythe, Jr., with cooperation of interested agencies throughout New York and New England.

MANAGEMENT

Project

Management of central hardwoods (M-2)

Scope

To determine the best methods of cutting central hardwoods and to develop effective silvicultural measures to improve the quality and growth of existing hardwood stands of varying composition and age. Studies included are (1) methods of cutting and cultural practices such as weeding, girdling, and thinnings; and (2) establishment and development of reproduction following different methods of treatment.

Status

Permanent plots established at various periods in the past form the basis of this study. Of a total of 52 plots aggregating 23.76 acres, 22 consist of two series established near Farmington and Windham, Connecticut, in 1906 to study the development of coppice stands following thinning. Another series of 5 located near Simsbury, Connecticut, were established in 1924 by the Station to study the immediate and future effects of fire in a 20 year old sprout hardwood stand, and the effect of thinning in such stands. Two additional sets of 23 plots at North Andover and Dover, Mass., comprise the remaining plots. These were originally established by the Bureau of Entomology in 1913 to determine how to develop stands resistant to the gipsy and brown-tail moths through forest management.

57

Results

Since the writing up of reports by Jensen following the remeasurement of Windham, Farmington, North Andover and Dover plots in 1930 no additional work has been done on this project.

Plans

The series of 5 thinning plots located in a 25-year old sprout hardwood stand near Simsbury, Conn., will be measured in the spring of 1933.

Assignment

M. Westvold, V. S. Jensen.

MANAGEMENT

Project

Growth, Development, and Management of Northern Pines and Hemlock. (M-3)

Scope

To determine the growth, development, and best methods of management of planted and natural grown northern pines and hemlock in both pure and mixed stands.

Status

No change in status of the various permanent plots included in this project occurred during the past year.

Results

Data from the pair of plots at Peterboro, N. H. demonstrating the effect of liberating a young white pine stand from gray birch canopy (N.H. 47-48) were worked up for use in connection with state programs of unemployment relief.

Plans for Fiscal Year 1934

At Mount Toby, Mass., the herbarium collection will be made on Massachusetts Plots 5-7, and further pruning will be done on Plots 8-10.

Assignment

Victor S. Jensen, Paul W. Stickel, and C. Edward Behre.

MENSURATION

Project

Growth and yield of spruce and balsam fir (ME-2)

Scope

To determine growth and yield of spruce and balsam fir in different types and in even-aged and uneven-aged stands.

Status

Yield tables for even-aged stands have been completed and published.

21 permanent sample plots in Vermont and New Hampshire are serving to check the normal yield tables and provide information on mortality and approach of understocked stands to normalcy.

One permanent sample plot on the Gale River Experimental in Forest was established in 1928/an uneven-aged stand of spruce and fir in mixture with hardwoods. Nothing further has been done on this phase of the project.

Results

Normal yield tables for spruce and balsam fir from 25 to 115 years of age have been published, and some work has been done on the application of these tables to understocked stands.

Progress during Past Year

None.

Plans

Follow development of permanent plots, establish additional plots in uneven-aged stands and hardwood mixtures when resources permit.

Assignment

L. H. Reineke.

PROTECTION

Project

Forest Fire Attack (Pf-1)

Scope

The study of forest fire attack is divided into (a) the indirect or prevention phase characterized by the analysis of forest fire statistics and (b) the direct or control phase characterized by experimentation with new materials and methods for suppressing fires.

(a) The analysis of forest fire statistics has a two-fold purpose, namely, to secure from available records accurate and complete information in regard to forest fire hazard, risk, and damage in different parts of the Northeast and to furnish forest administrators with such information as a guide in judging the efficiency of their protective organizations.

(b) The control phase of this project is concerned with testing the efficiency of new materials and equipment under actual burning conditions.

Status

(a) In cooperation with state forestry departments reports have been prepared setting forth the analysis of forest fire records for the years indicated: New Hampshire 1921-1925; Maine 1916-1925; and Vermont 1911-1926. The reports for the first two states have been published by the states indicated; the report for Vermont has been completed but no publication is contemplated. Fire records for Connecticut for 1921-1925 have been compiled and copies of the various tables have been distributed to the state forester of Connecticut.

(b) Thus far a series of tests have been made with commercial calcium chloride as a forest fire retardant. These investigations have shown that the chemical has a limited use in forest fire control. It has sufficient toxic properties to kill such small ground cover as grass and can therefore be used on fire lines. When applied either dry or wet to litter its deliquescent nature tends to keep the inflammable materials moist for a limited time. Because the salt is highly soluble its beneficial effect rapidly disappears during rainy periods.

Results

(a) No further work was done on the analysis of fire records.

(b) In the spring of 1932 an experiment was made with the extinguishing properties of Zenith Fire Dust on grass fires. The chemical was applied to the burning grass with a hand dusting machine. The results of the tests were a complete disappointment for the chemical proved much less efficient than water and no more effective than fine dirt. The report covering this study is as follows:

Stickel, Paul W.

May 1932. Progress Report on Extinguishing Tests with
Fire Dust. Typed 3 p.

Plans for Fiscal Year 1934

(a) Until additional funds are available so that one man can be assigned to devote his entire time to cooperating with state forestry departments, no further work on the analysis of fire records will be undertaken.

(b) No tests with new material and equipment are planned for during 1934.

Assignment

Paul W. Stickel, in charge.

PROTECTION

Project

Chestnut blight (Pd-1).

Scope

To study the feasibility of replacing native chestnut with resistant species or hybrids, or by development of resistant races of the native species.

Status

Because of attacks of a native fungus on the oriental chestnuts set in the field, it may be that our greatest hope lies in the finding of resistant native trees or the breeding of resistant new varieties.

Results

The public is calling attention with increasing frequency to resistant native trees which are producing nuts. Experimental plantings of oriental chestnut have been made as follows:

Connecticut;	Torrington,	3,000
Massachusetts;	Monterey,	1,500
	Mt. Toby,	100
	Amherst,	25
New York;	Glens Falls,	600
	Alpine	900
	Horseheads	
	(near Elmira)	2,500

The oriental chestnuts appear to be hardy but some were broken down by heavy masses of drifted snow. A native fungus is attacking them and killing twigs and leaders so that the outlook for the future is ominous.

Progress for 1932

The Division of Forest Pathology is examining the plantations

(Pd-1)

of oriental chestnuts carefully each year and noting their reaction to climate, fungi, insects, etc. A study of the native fungus which is attacking them is being carried on.

Plans for Fiscal Year 1934

To continue along present lines.

Assignment

Bureau of Plant Industry, Perley Spaulding

PROTECTION

Project

White pine blister rust (Pd-3).

Scope

Investigation of the disease for new developments in habits or character.

Status

Past investigations are published. Use of resistant species is advocated for critical areas or conditions.

Results

Experimental plantings have been made with Pinus peuce in New Hampshire, Vermont, and Massachusetts. A group of 19 trees which were planted in 1918 is reported in Ohio.

Progress for 1933

A study of secondary fungi of blister rust cankers is under-way.

Publications and reports

A report on the Wilmington, New York, experiment covering the years 1918 - 1930 is being prepared.

Spaulding, Parley. Pre-eradication scouting - stop, look, and listen.

Rept. Proc. Seventeenth Ann. Blister Rust Control Conference.

pp. 27-28. 1932. Mimeographed.

_____ Dietrich preferable authority for Gremartium ribicola. Phytopathology, in press.

Plans for Fiscal Year 1934

Routine studies only.

Assignment

PROTECTION

Project

Shade and ornamental tree diseases (Pd-5).

Scope

To answer inquiries in this subject.

Status

Entirely incidental and limited to local cases. A few cases require handling each year.

Results

Discovery of European larch canker. Investigation of willow scab with discovery of resistant willows.

Progress for 1933

In the winter of 1931-1932 much winter injury of various ornamentals occurred. The junipers and related species were especially damaged. Considerable damage to sugar maple shade trees has been noted as caused by the fungus Volvaria bonibycina.

Plans for Fiscal Year 1934

Routine examination of specimens submitted, and answer to inquiries.

Assignment

Bureau of Plant Industry, Perley Spaulding in cooperation with J. F. Collins.

1933

Minor Project

PROTECTION

Project

Miscellaneous forest tree diseases (Pd-6).

Scope

To include work upon forest tree diseases not covered by other projects.

Status

A collection of specimens of tree diseases is arranged for exhibit in the office, and many are collected and filed for reference. Literature on the tree diseases of the Northeast is indexed.

Results

The Nectria disease of birches and other hardwoods persists in serious character and is much more widespread and prevalent than has been supposed. The total damage caused is very large and appears to be almost overlooked by woodland owners. Stereum sanguinolentum assumes more importance in the forest. Dasyscypha diseases of conifers are being investigated.

Plans for Fiscal Year 1934

To be continued as at present, supplementing the work on other projects.

Progress for 1932

Resinosis of red and white pines in New York plantations and similar trouble in Maryland has come to our attention. Investigation is underway by other agencies. A similar trouble of Douglas fir reproduction is known in Colorado. The cause is unknown.

No new plantings of larch with the European larch canker have

been found, altho intensive search has been made for several years. The two known diseased plantations have been destroyed.

The Woodgate rust of Scotch pine has been reported from widely separated points in the provinces of Ontario, Quebec, and Nova Scotia.

The beech is dying extensively in Nova Scotia and New Brunswick from the attacks of the felted beech scale followed by Nectria. It has been found in Maine and Massachusetts this season. The fungus appears to be a weak parasite attacking the bark where the insect has worked previously.

Assignment

Bureau of Plant Industry, Perley Spaulding.

PROTECTION

Project

Heart Rots of Northern Hardwoods (Pd-S).

Scope

To determine the frequency and symptoms of heart rots in northern hardwoods, the significance of injuries leading to their entry, losses caused, relation of loss to external symptoms, and methods of management which will reduce their occurrence.

Status

Earlier observations showed that the heart rots seriously reduce the lumber yield in hardwoods of this region. In 1931 a number of selected trees showing various defects were felled and split open to permit study of rots within. Supplementary observations were made of logs decked on a rollway and of the output of defective logs at a sawmill.

Results

A set of rules for estimating cull in these species on the experimental forests has been formulated and distributed in the form of Technical Note 10.

Progress for 1932

Examination of the high stumps and wood from trees cut in the construction of roads showed a marked difference in decay conditions on the Gale River Experimental Forest as compared to the Bartlett Experimental Forest.

Plans for Fiscal Year 1934

As funds allow, this work will be extended to other localities, conditions, and species. Culture work is badly needed

(P4-8)

but will require additional permanent help before it can be effectively undertaken.

Assignment

Bureau of Plant Industry, Percy Spaulding

(Pl-7)

New York State Conservation Department of attacks on hard pines by Hyllobius pales and Hypomolyx piceus. It is expected that more work may be done on this problem the coming field season.

Assistance in scouting for the European pine shoot moth in Massachusetts was given the Massachusetts Conservation Department.

Miscellaneous collections of forest insects and new host material also were made from time to time.

Publications and reports

Spaulding, Perley, MacAloney, H. J., and Hepting, G. H.

Butt rot in balsam fir on the Gale River Forest.

Forest Worker, pages 12-13. July, 1932.

Investigation in decay of balsam fir. Technical Note.

11. Northeastern Forest Experiment Station, March 3, 1932. 3 mimeo. pages, 1 table.

MacAloney, H. J. and Hesley, M. W. Preliminary report on the control of mound building ants. (Typed manuscript, April 1933).

Plans for Fiscal year 1934

This project will be carried on indefinitely and work will be done on miscellaneous insects as occasion arises.

Assignment

Bureau of Entomology, H. J. MacAloney.

PROTECTION

Project

Miscellaneous forest and shade tree insects. (P1-7).

Scope

To make incidental observations on the life histories and habits of miscellaneous forest and shade tree insects and to carry on brief experiments on control measures. To answer inquiries on this subject and to collect insects and samples of the injury so as to augment the collection of each that is already on hand.

Status

This project will be carried on incidentally with the other work.

Results

This has been carried on as a part of the work of the entomologist stationed at the Northeastern Forest Experiment Station since 1925. A considerable collection of insects and insect injury has already been made and has been arranged in cases and riker mounts so as to be available for examination at any time.

Progress for 1932

Considerable work has been done in cooperation with Mr. N. W. Hesley, Harvard Forest, in developing simpler methods of combatting mound building ants in forest plantations. Carbon disulphide and ethylene dioxide were found most satisfactory for controlling this insect. Simple methods of applying the chemicals have been tried out and are reported in a preliminary report on this study.

A preliminary investigation was made thru the kindness of the